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Bromeliaceae species from coastal *restinga* habitats, Brazilian states of Rio de Janeiro, Espírito Santo, and Bahia.

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Abstract: Bromeliaceae is one of the most representative plant families in *restinga* habitats. We analyzed the species richness and composition of Bromeliaceae in 13 *restinga* habitats along the Brazilian coast. We found a total of 41 species distributed along the *restinga* habitats studied. The *restinga* of Praia do Sul, in the state of Rio de Janeiro, had the highest number of species (15), whereas the *restinga* of Abaeté, in the state of Bahia, had the lowest (4). Our data are suggestive that the Doce River may represent the limit of distribution for some bromeliad species, with some species occurring only south of that river and others occurring only to the north of it. The differences in Bromeliaceae species composition among *restinga* habitats probably are not only due to differences in local environmental conditions, but also due to the geographic distribution pattern of each species and to the present degree of disturbance at each *restinga*.

Introduction

Restingas are considered to be marginal habitats of the Atlantic Rainforest Domain (Scarano 2000; Oliveira-Filho and Fontes 2000) and about 80 % of the Brazilian coast is covered by those habitats, which occur from the states of Pará to Rio Grande do Sul (Araújo 1992; Lacerda et al. 1984; 1993; Cogliatti-Carvalho et al. 2001; Rocha et al. 2004b). *Restingas* are coastal habitats characterized by relatively harsh environmental conditions (i.e. high temperatures and insolation, low water availability, high salinity), and by sandy soils covered with xerophyllous arbustive and herbaceous vegetation (Zaluar and Scarano 2000; Scarano 2002). Along the Brazilian coast the *restinga* habitats present differences in physiognomy, structure and floristic composition (Lacerda et al. 1984; Rocha and Bergallo 1997; Araújo 1992; 2000).

The Bromeliaceae is one of the most representative plant families of *restinga* habitats (Cogliatti-Carvalho et al. 2000; Freitas et al. 2000; Araújo 2000; Rocha et al. 2004a; b), where these plants have an important role in facilitating the establishment of other plant species (Zaluar and Scarano 2000) and in providing resources to various animal groups (Rocha et al. 2000; 2004a). As the species in the family Bromeliaceae respond differently to environmental variations (Benzing 1980), and since each *restinga* habitat presents different environmental conditions (Freitas et al. 2000), we could expect that each *restinga* would have a distinct set of bromeliad species. In the present study we aimed to verify the bromeliad species composition of 13 different *restinga* habitats at three Brazilian states: Rio de Janeiro, Espírito Santo, and Bahia.

Material and methods

Study Site – From November 1999 to March 2000, we studied the bromeliad communities of 13 *restinga* habitats, along approximately 1,500 km of the Brazilian coast, in the states of Rio de Janeiro (Praia do Sul, Grumari, Barra de Maricá, Massambaba, Jurubatiba, and Grussaí), Espírito Santo (Praia das Neves, Setiba, and Guriri), and Bahia (Prado, Trancoso, Abaeté, and Baixio) (Table 1; Figure 1).

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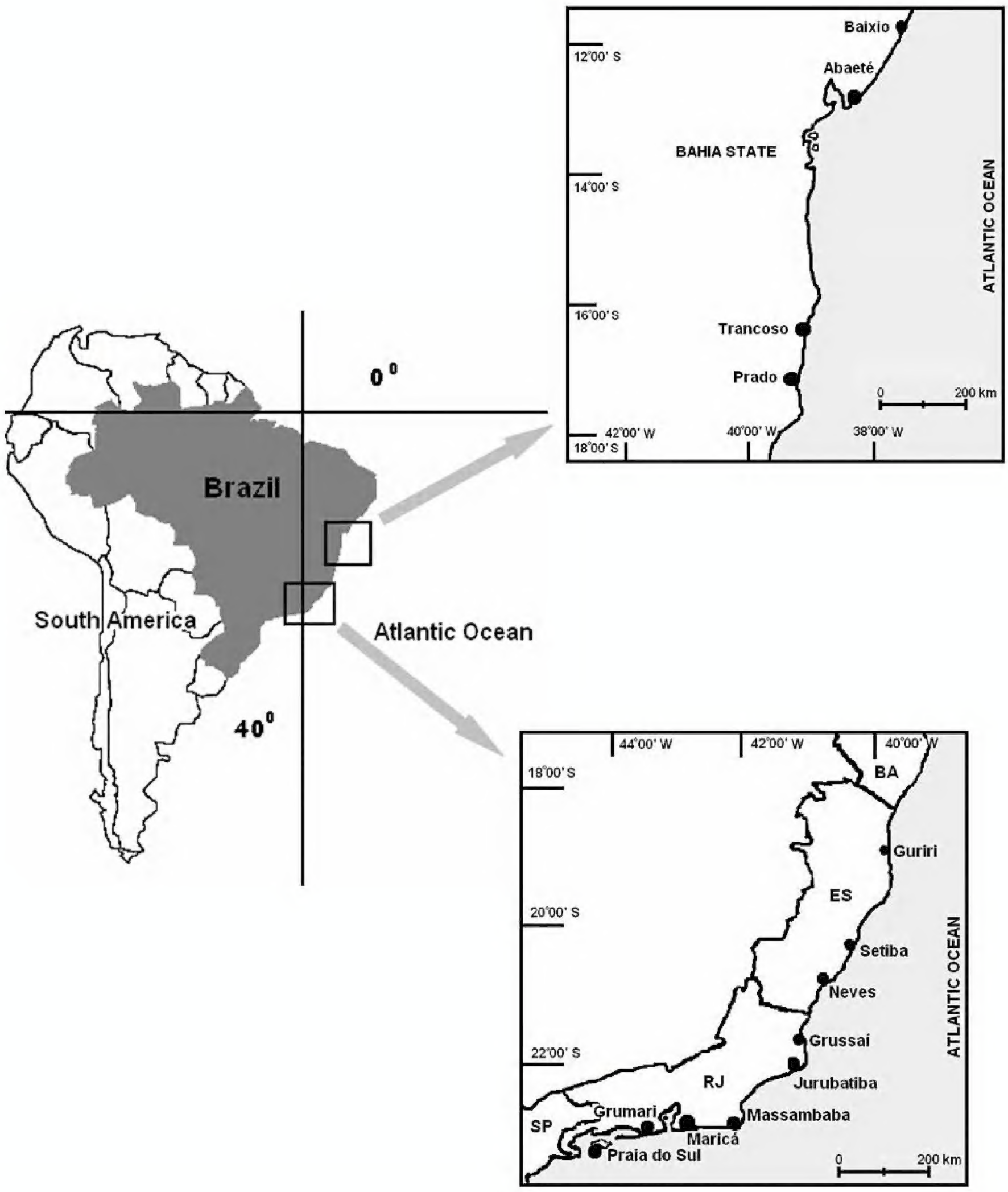

Figure 1. Map of eastern Brazil, with the states of Rio de Janeiro (RJ), Espírito Santo (ES), and Bahia (BA) in detail, and the 13 *restinga* habitats sampled.

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Table 1. Coordinates, municipalities and states of the 13 *restingas* studied along the Brazilian coast. RJ, Rio de Janeiro; ES, Espírito Santo; BA, Bahia.

Restinga	Coordinate	Municipality	State
Praia do Sul	23°10'28" to 23°10'48" S 44°17'12" to 44°17'27" W	Angra dos Reis	RJ
Grumari	23°02'52" to 23°02'48" S 43°32'26" to 43°31'01" W	Rio de Janeiro	RJ
Barra de Maricá	22°57'55" to 22°54'35" S 42°53'49" to 42°41'49" W	Maricá	RJ
Massambaba	22°58'32" to 22°56'38" S 42°08'57" to 42°01'57" W	Arraial do Cabo	RJ
Jurubatiba	22°18'31" to 22°01'05" S 41°42'23" to 41°09'54" W	Macaé	RJ
Grussaí	21°52'24" to 21°37'30" S 41°08'37" to 40°58'39" W	São João da Barra	RJ
Praia das Neves	21°18'00" to 21°11'53" S 40°59'50" to 40°57'30" W	Presidente Kennedy	ES
Setiba	20°37'47" to 20°32'13" S 40°25'57" to 40°22'53" W	Guarapari	ES
Guriri	18°43'33" to 18°35'55" S 39°43'38" to 39°46'58" W	São Mateus	ES
Prado	17°20'48" to 17°17'33" S 39°14'46" to 39°13'02" W	Prado	BA
Trancoso	16°41'24" to 16°38'57" S 39°06'46" to 39°05'39" W	Porto Seguro	BA
Abaeté	12°56'34" to 12°55'54" S 38°21'23" to 38°20'30" W	Salvador	BA
Baixio	11°58'06" to 11°53'13" S 37°39'14" to 37°35'15" W	Esplanada	BA

Data Collection - To analyze the bromeliad species composition at each *restinga* we sampled 100 plots, each measuring 100 m^2 (10 x 10 m), established at transects performed perpendicularly to the beach. Due to the different sizes of the *restingas*, the transects had different lengths, and were distant 50 m or more from one another, with the parcels being 10 m apart [for details of the method used see Cogliatti-Carvalho et al. (2000) and Freitas et al. (2000)]. We carefully checked the entire area inside each plot looking for bromeliads and all individuals found were identified and recorded. The specimens which were not identified in the field were photographed and collected, and the material was later sent to specialists for identification. Voucher material was housed at the Herbarium of the *Museu Nacional do Rio de Janeiro* (R).

Results and discussion

We found a total of 41 species of Bromeliaceae along the 13 *restinga* habitats studied (Table 2). The *restinga* of Praia do Sul, in southern Rio de Janeiro, had the highest number of species (15), whereas the *restinga* of Abaeté, in Bahia, had the lowest (4 species) (Table 2). According to Rocha et al. 2004b, the *restinga* of Praia do Sul presented the lowest habitat disturbance level whereas Abaeté had the highest one. The other *restinga* habitats that also had relatively high numbers of species (Setiba = 13, Grumari = 12, and Praia das Neves = 11 species) also had comparatively low habitat disturbance levels, which suggests that the degree of disturbance may negatively affects bromeliad richness in *restingas* (Rocha et al. 2004b). *Bromelia antiacantha* and *Tillandsia stricta* were the commonest species, occurring in eleven and in eight localities, respectively, while 21 species occurred at only one *restinga* habitat.

The species composition varied among localities and the differences tend to increase with the distance among areas. Our data are suggestive that the Doce River, which has been recognized as a geographic barrier for some animal groups (Rocha 2000), may represent the limit of distribution for some bromeliads.

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Table 2. List of the bromeliad species recorded at each of the 13 *restinga* habitats in the states of Rio de Janeiro, Espírito Santo, and Bahia.

	Praia do Sul	Grumari	Maricá	Massambaba	Jurubatiba	Grussaí	Praia das Neves	Setiba	Guriri	Prado	Trancoso	Abaeté	Baixio
Aechmea aquilega (Salisb.) Griseb.													X
Aechmea blanchetiana (Baker) L.B.Sm.									X	X	X	X	X
Aechmea bromeliifolia (Rudge) Baker					X		X				X		
Aechmea chlorophylla L.B.Sm.									X				
Aechmea distichantha Lem.	X												
Aechmea guaraparaiensis Mez							X						
Aechmea itapoana Morawetz & Morawetz .												X	
Aechmea lingulata (L.) Baker				X	X		X	X					X
Aechmea nudicaulis (L.) Griseb.	X		X		X	X	X	X					
Aechmea pectinata Baker	X												
Aechmea ramosa Mart. ex Schult.							X	X					
Aechmea sphaerocephala Baker		X									X		
Billbergia amoena (Lodd.) Lindl.	X	X	X	X			X						
Billbergia euphemiae E.Morren								X					
Billbergia pyramidalis (Sims) Lindl.		X											
Bromelia antiacantha Bertol.	X	X	X	X	X	X	X	X	X	X	X		
Cryptanthus sp.										X			
Edmundoa ambigua (Wand. & Leme) Leme	X												
Edmundoa lindenii (Regel) Leme	X												
Hohenbergia castellanosii L.B.Sm. & Read													X
Hohenbergia littoralis L.B.Sm.												X	X
Hohenbergia salzmannii (Baker) E.Morren ex Mez												X	X
Neoregelia cruenta (Graham) L.B.Sm.		X	X	X	X	X	X						
Neoregelia johannis (Carrière) L.B.Sm.	X												
Neoregelia mucugensis Leme													X
Neoregelia pascoaliana L.B.Sm.								X	X	X	X		
Neoregelia sarmentosa (Regel) L.B.Sm.		X											
Nidularium innocentii Lem.	X												
Portea silveirae Mez											X		
Pseudananas sagenarius (Arruda) Camargo								X	X	X	X		
Quesnelia quesneliana (Brongn.) L.B.Sm.		X				X	X	X					
Tillandsia gardneri Lindl.	X	X	X	X	X			X					
Tillandsia geminiflora Brongn.	X												
Tillandsia mallemontii Glaz. ex Mez		X											
Tillandsia recurvata (L.) L.					X			X					
Tillandsia stricta Sol.	X	X	X	X	X	X	X	X					
Tillandsia usneoides (L.) L.		X	X		X	X		X		X	X		
Vriesea gigantea Gaudich.	X												
Vriesea neoglutinosa Mez	X	X	X	X	X	X							
Vriesea procera (Mart. ex Schult.F.) Wittm.							X	X	X	X	X		
Vriesea rodigasiana E.Morren	X												

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Some species occurred only south of the Doce River (Praia do Sul to Setiba): *Aechmea nudicaulis*, *Billbergia amoena*, *Neoregelia cruenta*, *Tillandsia stricta*, and *Vriesea neoglutinosa*; others occurred only to the north of this river (Guriri to Abaeté): *Aechmea blanchetiana*, *A. aquilega*, *Hohenbergia littoralis*, *H. salzmannii,* and *H. castellanosii*.

We conclude that, as expected, the *restingas* studied differ in the bromeliad species composition and that such differences are probably due not only to differences in local environmental conditions, but also to the geographic distribution pattern of each species and to the present degree of disturbance at each *restinga*.

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